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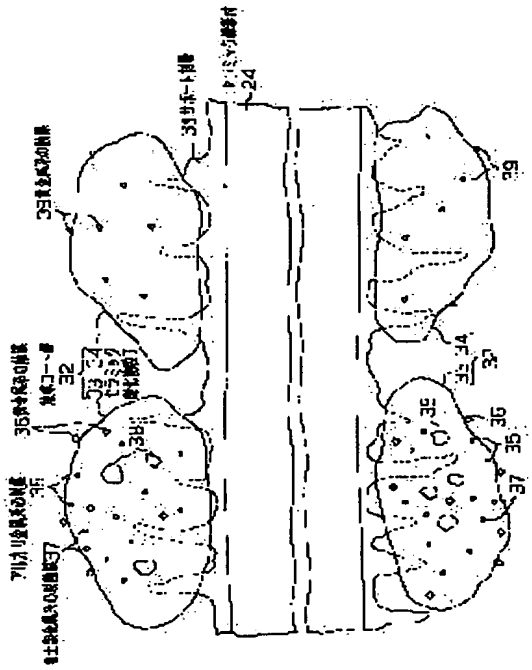
(54) CATALYST SUPPORTED FILTER FOR CLEANING EXHAUST GAS

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a catalyst supported filter for cleaning exhaust gas constituted by firmly fixing a catalyst coating layer to the surface of a ceramic fiber material in a dispersed state.

SOLUTION: The surface of the ceramic fiber material 24 constituting a catalyst carrier 23 is coated with a support material layer 31. Alumina particles 33 having an alkali metal catalyst (lithium) 35, a noble metal catalyst (platinum) 36 and titania particles 38 dispersed therein are fixed to the needle-like parts of the support material layer 31. Further, zirconia particles 34 having a noble metal catalyst (rhodium) 39 dispersed therein are fixed to the needle-like parts of the support material layer 31.



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CLAIMS

[Claim(s)]
[Claim 1] In the catalyst support filter for exhaust gas purification from which the hydrocarbon, the carbon monoxide, and nitrogen oxides which are equipped with the catalyst support which consists of ceramic fiber material, and are contained in an internal combustion engine's exhaust gas are removed The support material layer which is covered by the front face of the ceramic fiber material which constitutes said catalyst support, and consists of needle crystal of a ceramic oxide, The catalyst support filter for exhaust gas purification characterized by having the catalyst coat layer which consists of a particle of the ceramic oxide which supports the catalyst of an alkali-metal system or an alkaline-earth-metal system, and the catalyst of a noble-metals system, and is supported by said support material layer.
[Claim 2] The ceramic oxide which constitutes said catalyst coat layer is a catalyst support filter for exhaust gas purification according to claim 1 characterized by including at least one chosen from an alumina, a zirconia, a titania, and a silica.
[Claim 3] The ceramic oxide which constitutes said support material layer is a catalyst support filter for exhaust gas purification according to claim 1 or 2 characterized by including at least one chosen from an alumina, a zirconia, a titania, and a silica.
[Claim 4] The ceramic oxide which constitutes the ceramic oxide which constitutes said support material layer, and said catalyst coat layer is a catalyst support filter for exhaust gas purification according to claim 3 characterized by being the same ingredient.
[Claim 5] The catalyst support filter for exhaust gas purification given in any 1 term of claims 1-4 characterized by the co-catalyst of a rare earth metal system being supported by the particle of the ceramic oxide of a catalyst coat layer.
[Claim 6] Said co-catalyst is a catalyst support filter for exhaust gas purification according to claim 5 characterized by including at least one simple substance or compound chosen from a cerium and a lanthanum.
[Claim 7] The ingredient of said catalyst support is a catalyst support filter for exhaust gas purification given in any 1 term of claims 1-6 characterized by being either silicon carbide, an alumina, silicon nitride, cordierite, a mullite, sialon, a silica and a phosphoric-acid zirconium.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the catalyst support filter for exhaust gas purification from which the hydrocarbon, the carbon monoxide, and nitrogen oxides which are contained in exhaust gas are removed.
[0002]
[Description of the Prior Art] The number of an automobile is increasing by leaps and bounds, and the increment of it also with the rapid amount of the exhaust gas taken out by the internal combustion engine of an automobile in proportion to it is being enhanced. Since the various matter contained in the exhaust gas which especially a diesel power plant takes out becomes the cause which causes contamination, in current, it is having effect serious for a world environment. Moreover, the research result that particulates, such as soot contained in exhaust gas, become the cause which sometimes causes reduction of an allergy failure or a sperm count is also reported by recently. That is, it is considered to be a urgent technical problem for human beings to take the cure which removes the particulate in exhaust gas.
[0003] The exhaust gas purification filter equipped with the catalyst support which consists of ceramic fiber material as the basis of such a situation, for example, a catalyst support filter for exhaust gas purification which purifies the exhaust gas of a diesel power plant, is proposed. The purification filter is held in casing prepared in the middle of the exhaust pipe which lets the exhaust gas discharged by the internal combustion engine pass. And the particulate contained in the exhaust gas is removed by making a purification filter pass the exhaust gas discharged by the internal combustion engine.
[0004] It considers removing conventionally harmful matter, such as a hydrocarbon (HC) contained in exhaust gas, a carbon monoxide (CO), and nitrogen oxides (NOx), as this kind of a purification filter. It forms a catalyst coat layer in the front face of catalyst support which consists of ceramic fiber material, and supports the catalyst which becomes this catalyst coat layer from noble metals, alkali metal, etc., such as Pt, Pd, and Rh. It dries and calcinates, after sinking catalyst support into the slurry containing alumina powder as an approach of forming a catalyst coat layer on the surface of catalyst support. In case exhaust gas passes in such a purification filter, then a purification filter, oxidation removal of the carbon monoxide and hydrocarbon which are contained there, and reduction removal of nitrogen oxides can be performed efficiently.
[0005]
[Problem(s) to be Solved by the Invention] However, the front face of the ceramic fiber material which constitutes catalyst support is smooth. Therefore, even if it sinks a slurry into catalyst support, a catalyst coat layer is unevenly distributed in the specific part of ceramic fiber material due to surface tension. Consequently, it is no longer supported with the condition of having distributed to catalyst support by homogeneity, and the effectiveness as a catalyst falls.
[0006] Moreover, when a catalyst coat layer is formed from an alumina, the fault peculiar to an alumina shown below arises. That is, the sulfur dioxide (SO2) contained in exhaust gas oxidizes according to a metal catalyst in a hyperoxia ambient atmosphere, and turns into a sulfur trioxide (SO3). And if that sulfur trioxide reacts with the steam contained in exhaust gas, it becomes a sulfuric acid (H2SO4) and this sulfuric acid adheres to an alumina, it will become the cause that the

endurance of a catalyst coat layer falls. Therefore, the front face of ceramic fiber material is made to support the catalyst coat layer which consists of an alumina as thinly as possible, and to carry out that it is easy to make it secede from a sulfuric acid is desired.
[0007] This invention is made paying attention to the trouble which exists in such a Prior art. The purpose is in offering the catalyst support filter for exhaust gas purification which can fix a catalyst coat layer to the front face of ceramic fiber material dispersedly powerfully.
[0008]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, in invention according to claim 1 In the catalyst support filter for exhaust gas purification from which the hydrocarbon, the carbon monoxide, and nitrogen oxides which are equipped with the catalyst support which consists of ceramic fiber material, and are contained in engine exhaust gas are removed The support material layer which is covered by the front face of the ceramic fiber material which constitutes said catalyst support, and consists of needle crystal of a ceramic oxide, It consists of a particle of the ceramic oxide which supports the catalyst of an alkali-metal system or an alkaline-earth-metal system, and the catalyst of a noble-metals system, and let it be a summary to have the catalyst coat layer supported by said support material layer.
[0009] In invention according to claim 2, the ceramic oxide which constitutes said catalyst coat layer makes it a summary to include at least one chosen from an alumina, a zirconia, a titania, and a silica in the catalyst support filter for exhaust gas purification according to claim 1.
[0010] In invention according to claim 3, the ceramic oxide which constitutes said support material layer makes it a summary to include at least one chosen from an alumina, a zirconia, a titania, and a silica in the catalyst support filter for exhaust gas purification according to claim 1 or 2.
[0011] The ceramic oxide which constitutes the ceramic oxide which constitutes said support material layer, and said catalyst coat layer from invention according to claim 4 in the catalyst support filter for exhaust gas purification according to claim 3 makes it a summary to be the same ingredient.

[0012] Let it be a summary to support the co-catalyst of a rare earth metal system in invention according to claim 5 at the particle of the ceramic oxide of a catalyst coat layer in the catalyst support filter for exhaust gas purification given in any 1 term of claims 1-4.
[0013] In invention according to claim 6, said co-catalyst makes it a summary to include at least one simple substance or compound chosen from a cerium and a lanthanum in the catalyst support filter for exhaust gas purification according to claim 5.
[0014] In invention according to claim 7, the ingredient of said catalyst support makes it a summary to be either silicon carbide, an alumina, silicon nitride, cordierite, a mullite, sialon, a silica and a phosphoric-acid zirconium in the catalyst support filter for exhaust gas purification given in any 1 term of claims 1-6.
[0015] Hereafter, "an operation" of this invention is explained. According to invention according to claim 1, the support material layer which becomes the front face of catalyst support which consists of ceramic fiber material from the needle crystal of a ceramic oxide is covered. The catalyst coat layer which turns into the support material layer from the ceramic oxide particle which has a catalyst is supported. Therefore, a needlelike support material layer is resisting and a catalyst coat layer stops easily being able to secede from the front face of a support material layer. Moreover, since the support material layer is covered by homogeneity to the front face of ceramic fiber material, it can make the whole catalyst support distribute and support the ceramic oxide particle which constitutes a catalyst coat layer. Furthermore, since the specific surface area of ceramic fiber material becomes large, it becomes possible to make many ceramic oxide particles support.
[0016] According to invention according to claim 2, the ceramic oxide which constitutes a catalyst coat layer contains at least one chosen from an alumina, a zirconia, a titania, and a silica. Therefore, since these ceramic oxides have a high specific surface area, they are suitable as what supports a catalyst. When a titania is chosen especially, it becomes possible to promote that the sulfur component which bars the activity of a catalyst secedes from catalyst support. For example, since many sulfur components are contained in the fuel when using the catalyst support filter for exhaust gas purification for what purifies the exhaust gas of a diesel power plant, it can be said that it is effective to use these oxides for catalyst support.

[0017] According to invention according to claim 3, the ceramic oxide which constitutes said support material layer contains at least one chosen from an alumina, a zirconia, a titania, and a silica. Therefore, these ceramic oxides have a high specific surface area, and are suitable as what supports a catalyst coat layer. When a titania is chosen especially, it becomes possible to promote that the sulfur component which bars the activity of a catalyst secedes from catalyst support. For example, since many sulfur components are contained in the fuel when using the catalyst support filter for exhaust gas purification for what purifies the exhaust gas of a diesel power plant, it can be said that it is effective to use these oxides for catalyst support.
[0018] According to invention according to claim 4, the ceramic oxide which constitutes the ceramic oxide which constitutes a support material layer, and said catalyst coat layer is the same ingredient. Therefore, compared with the case where it uses combining an ingredient of a different kind, both compatibility becomes high, and it becomes possible to make a catalyst coat layer adhere to a support material layer powerfully. Therefore, when the catalyst support filter for exhaust gas purification is washed, for example, a catalyst coat layer stops being able to secede from a support material layer easily.
[0019] According to invention according to claim 5, the co-catalyst of a rare earth metal system is supported by the particle of the ceramic oxide of a catalyst coat layer. Therefore, compared with the case where only said catalyst is used independently, supply of the oxygen to the inside of exhaust gas can be made active by the oxygen density accommodation in exhaust gas. For example, in using the catalyst support filter for exhaust gas purification for what purifies the exhaust gas of a diesel power plant, the combustion removal effectiveness of a diesel particulate improves.
[0020] According to invention according to claim 6, the co-catalyst contains at least one simple substance or compound chosen from a cerium and a lanthanum. Therefore, the endurance of a catalyst can be improved.
[0021] According to invention according to claim 7, since it is either silicon carbide, an alumina, silicon nitride, cordierite, a mullite, sialon, a silica and a phosphoric-acid zirconium, the ingredient of catalyst support can be used as the catalyst support filter for exhaust gas purification excellent in thermal resistance and thermal conductivity.
[0022]
[Embodiment of the Invention] Hereafter, 1 operation gestalt which materialized the catalyst support filter for exhaust gas purification of this invention to the exhaust gas purge for diesel power plants is explained to a detail based on a drawing.
[0023] As shown in drawing 1 , the 1st exhaust pipe 13 and the 2nd exhaust pipe 14 are arranged in the downstream of the exhaust manifold 12 prepared in the diesel power plant 11 as an internal combustion engine. The exhaust gas purge 15 is formed between the 1st exhaust pipe 13 and the 2nd exhaust pipe 14. This exhaust gas purge 15 is equipped with the tubed casing 16. The upstream edge of casing 16 is connected with the downstream edge of the 1st exhaust pipe 13, and the downstream edge of casing 16 is connected with the upstream edge of the 2nd exhaust pipe 14. It can also be grasped that casing 16 is arranged in the way of exhaust pipes 13 and 14. Consequently, the contrant region of the 1st exhaust pipe 13, casing 16, and the 2nd exhaust pipe 14 is mutually open for free passage, and exhaust gas flows the inside of it.
[0024] The heat insulator 17 which prevents that heat radiates heat is arranged outside by the inner skin of casing 16. The exhaust gas purification filter 18 which is a catalyst support filter for exhaust gas purification is supported by the heat insulator 17 through fixing metal 19. Since the purification filter 18 is what removes a diesel particulate, generally it is called a diesel particulate filter (DPF).
[0025] The purification filter 18 is formed in the shape of a cylinder, and the path is small rather than the path of a heat insulator 17. From that, the exhaust gas installation path 20 is formed between the peripheral face of the purification filter 18, and the inner skin of a heat insulator 16. Shields 21 and 22 are formed in the both ends of the purification filter 18. While upstream opening 18a of the purification filter 18 is closed by the upstream shield 21, upstream inlet-port 20a of the exhaust gas installation path 20 is opened wide. On the other hand, while downstream opening 18b of the purification filter 18 is opened wide, downstream outlet 20b of the exhaust gas installation path 20 is closed by the downstream shield 22.
[0026] Therefore, the exhaust gas which flowed in from the upstream inlet-port 20a side of the

exhaust gas installation path 20 passes the purification filter 18, and flows to the inside. In case exhaust gas passes through the purification filter 18, the trap of the diesel particulate contained in exhaust gas is carried out. And only the purified exhaust gas is discharged from downstream outlet 18b of the purification filter 18.

[0027] The purification filter 18 is equipped with the catalyst support 23 manufactured by carrying out the laminating of the ceramic fiber material 24 to the shape of felt at random. The thickness of catalyst support 23 is set as the range of 3-5mm. It is also possible to change the thickness of catalyst support 23 into any value within the limits of 2-15mm besides this range.

[0028] As the ingredient of catalyst support 23, i.e., an ingredient of the ceramic fiber material 24, there is silicon carbide fiber material or a SiC-Ti-O system fiber material (Si-C-O, Si-Ti-C-O). The path of the ceramic fiber material 24 is set as 5-15 micrometers, and die length is set as the range of 30-150mm. In addition, as an ingredient of catalyst support 23, an alumina, silicon nitride, cordierite, a mullite, sialon, a silica, and a phosphoric-acid zirconium can be chosen in addition to silicon carbide.

[0029] As shown in drawing 2 , the support material layer 31 which consists of needle crystal is covered by the front face of the ceramic fiber material 24 which constitutes catalyst support 23. This support material layer 31 is a thin film which consists of an alumina (aluminum 2O3) as a ceramic oxide. If it has way of speaking needlelike [the configuration of the support material layer 31], and another, the hair transplantation structure which bristled with the shape of fibril is presented. So, in order that the mutual point of contact of the adjoining alumina fibril may decrease, thermal resistance improves remarkably.

[0030] Generally, an alumina has a high specific surface area and the reason for having used the support material layer 31 as the thin film of an alumina is that it is suitable as catalyst support film. In connection with current and it which are expected especially development of the heat-resistant high purification filter 18, higher thermal resistance is demanded also about the support material layer 31.

[0031] And the support material layer 31 is thinly covered by the front face of each ceramic fiber material 24 according to the individual, and, moreover, the support material layer 31 is in the condition of having stuck firmly with each ceramic fiber material 24. Therefore, in washing the purification filter 18, it becomes what was excellent in washability as the support material layer 31 did not exfoliate from catalyst support 23. In addition, the area to which exhaust gas contacts a catalyst becomes large. Therefore, CO in exhaust gas and oxidation of HC can be promoted.

[0032] In addition, catalyst support 23 may be changed into at least one ceramic oxide chosen from a zirconia (zirconium dioxide: ZrO2), a titania (titanium oxide: TiO2), and a silica (oxidation silicon: SiO2) also besides making it an alumina.

[0033] Speaking concretely, as one kind of ceramic oxide, there being ZrO2, TiO2, or SiO2. As two kinds of ceramic oxides, there is combination of aluminum 2O3/ZrO2 and aluminum 2O3/TiO2 and aluminum 2O3/ZrO2 [SiO2 and]/TiO2, or ZrO2/SiO2. As three kinds of ceramic oxides, there is combination of 2O3/ZrO2/aluminum [SiO2 and] 2O3 of 2O3/ZrO2/TiO2 and aluminum of aluminum/TiO2/SiO2, or ZrO2/TiO2/SiO2. As four kinds of ceramic oxides, there is combination of 2O3/ZrO2/TiO2/SiO2 of aluminum.

[0034] The support material layer 31 does not cover catalyst support 23 uniformly, and covers the front face of the ceramic fiber material 24 which constitutes catalyst support 23 substantially. If this is said more correctly, the front face of each ceramic fiber material 24 is covered with the support material layer 31 according to the individual. therefore, the clearance between the ceramic fiber material 24 -- **** suggestion **** -- since there are nothings and the permeability of the purification filter 18 is secured, pressure loss does not become large.

[0035] At least one of gamma1aluminum 2O3, delta-aluminum 2O3, and theta-aluminum 2O3 is contained in the structure of this support material layer 31, i.e., the crystal structure of the alumina thin film formed by covering the front face of each ceramic fiber material 24. The diameter of the letter alumina crystal of a fibril projection which constitutes the support material layer 31 is 2-50nm, and the ratio of an overall length/diameter has [die length] the configuration of 5-50 by 20-300nm. And the thickness of the support material layer 31 which consists of such structure is 0.5 micrometers or less, and, as for the specific surface area of the alumina of alumina criteria, it is

desirable that it is 50-300m2/g.
[0036] The thickness of the support material layer 31 said here is the average of the distance from the front face of the ceramic fiber material 24 to the furthest part of the alumina crystal of the letter of a fibril projection. In addition, the diameter of an alumina crystal has more desirable 5-20nm, and, as for the ratio of an overall length/diameter, 10-30 are more desirable.
[0037] The reason which limits the property of the letter support material layer 31 of a fibril projection as mentioned above is because it becomes impossible to support with the powerful adhesion force the catalyst coat layer 32 which carries out a postscript while it will become difficult to secure a required specific surface area, if the die length of the letter support material layer 31 of a fibril projection is smaller than 20nm. It is because it will become weak structurally on the other hand if the die length of the letter support material layer 31 of a fibril projection is larger than 300nm. When this becomes it is smaller than 2nm, and larger than 50nm about a diameter, while it becomes impossible to support the catalyst coat layer 22, it is because reservation of the specific surface area of desirable magnitude becomes difficult. Moreover, about the ratio of an overall length/diameter, if it is difficult to secure a required specific surface area if this ratio is smaller than 5 and it becomes large from 50 on the other hand, it will become weak structurally. Therefore, it is because the case where a fibril-like projection breaks arises by washing the purification filter 18.
[0038] The catalyst coat layer 32 is supported by the support material layer 31. This catalyst coat layer 32 consists of an alumina particle 33 which is a particle of ceramic oxide, and a zirconia particle 34. Besides these ceramic oxide particles, a titania, a silica, or the thing containing at least one chosen from them may be used.
[0039] Speaking concretely, as one kind of ceramic oxide, there being TiO2 or SiO2 other than said aluminum2O3 and ZrO2. As two kinds of ceramic oxides, there is combination of aluminum 2O3/ZrO2 and aluminum 2O3/TiO2 and aluminum 2O3/ZrO2 [SiO2 and]/TiO2, or ZrO2/SiO2. As three kinds of ceramic oxides, there is combination of 2O3/ZrO2/aluminum [SiO2 and] 2O3 of 2O3/ZrO2/TiO2 and aluminum of aluminum/TiO2/SiO2, or ZrO2/TiO2/SiO2. As four kinds of ceramic oxides, there is 2O3/ZrO2/TiO2/SiO2 of aluminum.
[0040] In addition, if it is chosen as the catalyst coat layer 32 from a titania particle, there is an advantage which promotes that the sulfur component which bars the activity of a catalyst secedes from catalyst support 23. This can be said to be effective when adopting as a purification filter 18 for diesel-power-plant 11, since many many sulfur components are contained in the fuel of a diesel power plant 11.
[0041] In the front face of the alumina particle 33 which constitutes said catalyst coat layer 32, the catalyst 35 of an alkali-metal system, the catalyst 36 of a noble-metals system, and the co-catalyst 37 of a rare earth metal system are distributed by homogeneity. As a catalyst 35 of this alkali-metal system, at least one simple substance or compound chosen from a lithium (Li), sodium (Na), and a potassium (K) is raised. for example, the duality according to the combination of said element as said compound -- a system alloy and ternary alloy are used. duality -- there are Li/Na, Na/K, and Li/Na as a system alloy. There is Li/Na/K as ternary alloy.
[0042] In addition, it is also possible to replace with the catalyst 35 of said alkali-metal system, and to support the catalyst of an alkaline-earth-metal system on the front face of the alumina particle 33. As a catalyst of an alkaline earth metal system, at least one simple substance or compound chosen from barium (Ba), magnesium (Mg), and calcium (calcium) is raised.
[0043] As a catalyst 36 of a noble-metals system, at least one simple substance or compound chosen from a rhodium (Rh), platinum (Pt), palladium (Pd), gold (Au), silver (Ag), and copper (Cu) may be supported to the alumina particle 33. for example, the duality as a compound -- as a system alloy, there are Rh/Pt, Rh/Pd, Rh/Au, Rh/Ag, Rh/Cu, Pt/Pd, Pt/Au, Pt/Ag, Pt/Cu, Pd/Au, Pd/Ag, Pd/Cu, Au/Ag, Au/Cu, and Ag/Cu. As ternary alloy, moreover, Rh/Pt/Pd, Rh/Pt/Au, Rh/Pt/Ag, Rh/Pt/Cu, Rh/Pd/Au, Rh/Pd/Ag, Rh/Pd/Cu, Rh/Au/Ag, Rh/Au/Cu, Rh/Ag/Cu, Pt/Pd/Au, As a co-catalyst 37 of a rare earth metal system with Pt/Pd/Ag, Pt/Pd/Cu, Pd/Au/Ag, Pd/Au/Cu, Pd/Ag/Cu, and Au/Ag/Cu At least one simple substance chosen from a cerium (Ce) and a rare earth metal like a lanthanum (La) or a rare earth oxide like Seria (CeO2) or Lantana (La 2O3) is raised. In this operation gestalt, a lithium is chosen as a catalyst 35 of an alkali-metal system, platinum is chosen as a catalyst 36 of a noble-metals system, and Seria is chosen as a co-catalyst 37.

[0044] When Seria etc. is distributed in the alumina particle 33 (it is more desirable to distribute with the catalyst 36 of noble-metals systems, such as Pt, preferably), by the oxygen density accommodation which Seria has, supply of the oxygen to the inside of exhaust gas will be made active, and the combustion removal effectiveness of "the soot (diesel particulate)" adhering to a filter will improve, as a result the regeneration rate of the catalyst support filter 10 will improve remarkably. Moreover, the endurance of catalyst support 33 can be raised.
[0045] That is, it not only raises the thermal resistance of an alumina, but rare earth oxides, such as Seria, play the role which adjusts the oxygen density in the front face of catalyst support 33. Generally, since the exhaust gas presentation is continuously changed between the rich region of a fuel, and the Lean region, the operation ambient atmosphere of the front face of the catalyst support filter 10 will also be changed violently. By the way, if exhaust gas becomes a rich region, oxygen will be supplied into an ambient atmosphere, but if it becomes the Lean region conversely, occlusion of the surplus oxygen in an ambient atmosphere will be carried out. Thus, said Seria bears the operation which expands the width of face of the air-fuel ratio which can remove a hydrocarbon, a carbon monoxide, or NOx efficiently by adjusting the oxygen density in an ambient atmosphere.
[0046] The titania particle 38 is supported by the alumina particle 33 besides catalyst [which were mentioned above] 35 and 36 and co-catalyst 37. If a sulfur dioxide adheres to the alumina particle 33, the reason for making the alumina particle 33 support the titania particle 38 will oxidize according to a metal catalyst in a hyperoxia ambient atmosphere, and will serve as a sulfur trioxide (SO3). And it is because an alkali-metal salt (Na2SO4) will be formed if this sulfur trioxide reacts with the steam contained in exhaust gas, it becomes a sulfuric acid (H2SO4) and this sulfuric acid adheres to an alumina. Therefore, the sulfur dioxide (SO2) contained in exhaust gas stops being able to adhere to the alumina particle 33 easily by making the alumina particle 33 support the titania particle 38. Even if a sulfur dioxide adheres to the alumina particle 33 with it, it can carry out from there that it is easy to make it secede from a sulfur dioxide.
[0047] The catalyst 39 of a noble-metals system is supported by the zirconia particle 34 which constitutes said catalyst coat layer 32. As a catalyst 36 of a noble-metals system, at least one chosen from a rhodium (Rh), platinum (Pt), and palladium (Pd) is raised. With this operation gestalt, the catalyst 39 of the noble-metals system supported by the zirconia particle 34 serves as a rhodium. The reason for having made the zirconia particle 34 support a rhodium is that the capacity to return to hydrogen the steam contained in exhaust gas rather than the time of making said alumina particle 33 support becomes high.
[0048] When manufacturing the purification filter 18 mentioned above, the support material layer 31 is formed in the front face of the ceramic fiber material 24 of catalyst support 33 with a sol-gel method. That is, the mixed water solution of an aluminium nitrate and a cerium nitrate is infiltrated into catalyst support 33. Thereby, the support material layer 31 is covered by the front face of each ceramic fiber material 24. And it is made to change to the alumina thin film which presents needlelike structure (hair transplantation structure) which bristled the micro cross-section structure of the support material layer 31 with fibril by passing through hot water down stream processing after temporary baking.
[0049] Then, after mixing alumina powder and titania powder to a dinitrodiammine platinum solution, the mixture is dried and it calcinates further. Thereby, the alumina system raw material with which a titania and platinum were supported by the alumina particle is generated. Moreover, after mixing zirconia powder in a nitric-acid rhodium water solution, the mixture is dried and it calcinates further. Thereby, the zirconia system raw material with which the rhodium was supported by the zirconia particle is generated. Then, said alumina system raw material and a zirconia system raw material are mixed, and let water be the slurry of optimum dose, in addition predetermined concentration. Furthermore, milling of the slurry is carried out and, finally it is prepared. The catalyst support 23 with which the support material layer 31 was covered by the prepared slurry is infiltrated, and catalyst support 23 is dried and calcinated after that. The catalyst coat layer 32 is fixed by the front face of the support material layer 31 through these processes (support).
[0050] The description of this operation gestalt is shown below.
(1) The support material layer 31 is covered by the front face of the ceramic fiber material 24 which constitutes catalyst support 23. The alumina particle 33 by which the catalyst (lithium) 35 of an

alkali-metal system, the catalyst (platinum) 36 of a noble-metals system, and the titania particle 38 were distributed is fixed to the needlelike part of the support material layer 31. Moreover, the zirconia particle 34 by which the catalyst (rhodium) 39 of a noble-metals system was distributed is fixed to the needlelike part of the support material layer 31. Therefore, since the front face has irregularity by the needlelike part, the support material layer 31 is resisting, and the alumina particle 33 and the zirconia particle 34 stop being able to secede from the support material layer 31 easily. In other words, the adhesion force of the alumina particle 33 to the support material layer 31 and the zirconia particle 34 becomes high. Therefore, the adhesion force and strength of the catalyst coat layer 32 can be improved according to the anchor effect by the needlelike part of the support material layer 31. Consequently, since the catalyst coat layer 32 falls out and it is no longer discharged in atmospheric air, it becomes environment-friendly.

[0051] (2) Since the support material layer 31 is supported by homogeneity in the whole front face of the ceramic fiber material 24, the alumina particle 33 and the zirconia particle 34 which constitute the catalyst coat layer 32 can be made to adhere to each ceramic fiber material 24 at homogeneity. Consequently, homogeneity can be made to distribute the catalyst 35 of an alkali-metal system, the catalysts 36 and 39 of a noble-metals system, a co-catalyst 37, and the titania particle 38, respectively.

[0052] (3) Since the alumina particle 33 and the zirconia particle 34 which constitute the catalyst coat layer 32 have a high specific surface area, they are suitable as what supports a catalyst.

[0053] (4) Both the support material layer 31 and the catalyst coat layer 32 are aluminas. Therefore, compared with the case where it uses combining an ingredient of a different kind, both compatibility becomes high, and the catalyst coat layer 32 can be stuck much more powerfully to the support material layer 31. Therefore, it can prevent that the catalyst coat layer 32 exfoliates by washing of the catalyst support filter 10.

[0054] (5) Compared with the case where catalysts 35 and 39 are independently used for it since the co-catalyst 37 of a rare earth metal system is supported by the alumina particle 33 which constitutes the catalyst coat layer 32, supply of the oxygen to the inside of exhaust gas can be made active by the oxygen density accommodation in exhaust gas. Therefore, it becomes possible to be efficient and to carry out combustion removal of the diesel particulate by which uptake was carried out to the purification filter 18.

[0055] (6) The support material layer 31 is thinly supported by the front face of the ceramic fiber material 24. Therefore, the sulfur oxide (SO2) contained in exhaust gas oxidizes, and even if it reacts with a steam and serves as a sulfuric acid (H2SO4), the sulfuric acid becomes easy to break away. Therefore, the endurance of the purification filter 18 improves.

[0056] In addition, the operation gestalt of this invention may be changed as follows.

- It used for purifying the exhaust gas discharged from a diesel power plant 11 in the purification filter 18 with said operation gestalt. You may use it for the purification filter 18 which purifies the exhaust gas discharged from the engine driven with a gasoline or an alcoholic system fuel besides this.

[0057] Next, the technical thought grasped according to the operation gestalt mentioned above is shown below besides the technical thought indicated by the claim.

(1) The exhaust gas purge characterized by carrying out uptake of the particulate contained in the exhaust gas which holds the catalyst support filter for exhaust gas purification according to claim 1 to 7 in casing prepared on an internal combustion engine's exhaust air passage, and is discharged by the internal combustion engine with the filter.

[0058]

[Effect of the Invention] According to this invention, a catalyst coat layer can be powerfully fixed to the front face of ceramic fiber material dispersedly.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The conceptual diagram which equipped the exhaust gas purge with the catalyst support filter.
[Drawing 2] The explanatory view expanding and showing the ceramic fiber material which constitutes catalyst support.
[Description of Notations]
11 [-- Ceramic fiber material, 31 / -- A support material layer, 32 / -- A catalyst coat layer, 33 / -- An alumina particle (particle of ceramic oxide), 34 / -- A zirconia particle (particle of ceramic oxide), 35 / -- The catalyst of an alkali-metal system, 36 / -- The catalyst of a noble-metals system, 37 / -- The co-catalyst of a rare earth metal system, 39 / -- Catalyst of a noble-metals system.] -- A diesel power plant (internal combustion engine), 18 -- The catalyst support filter for exhaust gas purification, 23 -- Catalyst support, 24

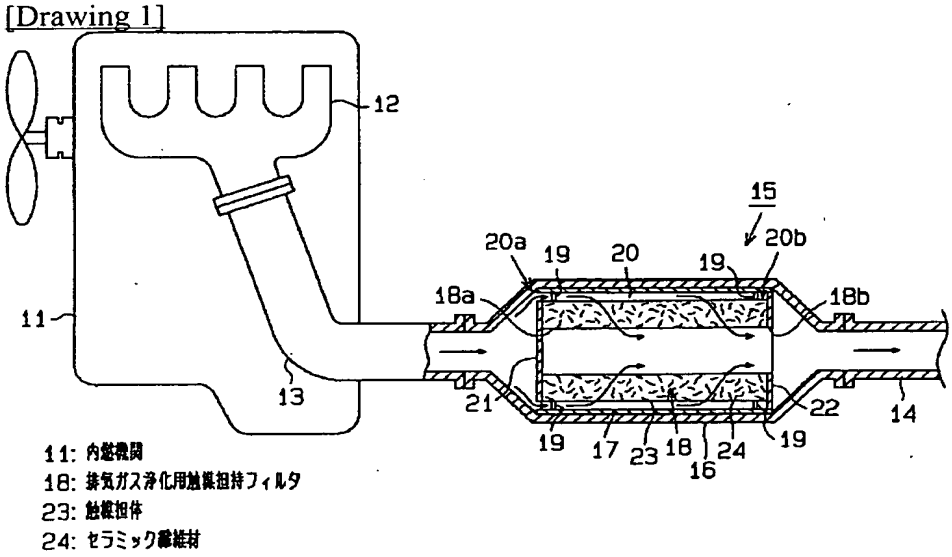
[Translation done.]

* NOTICES *

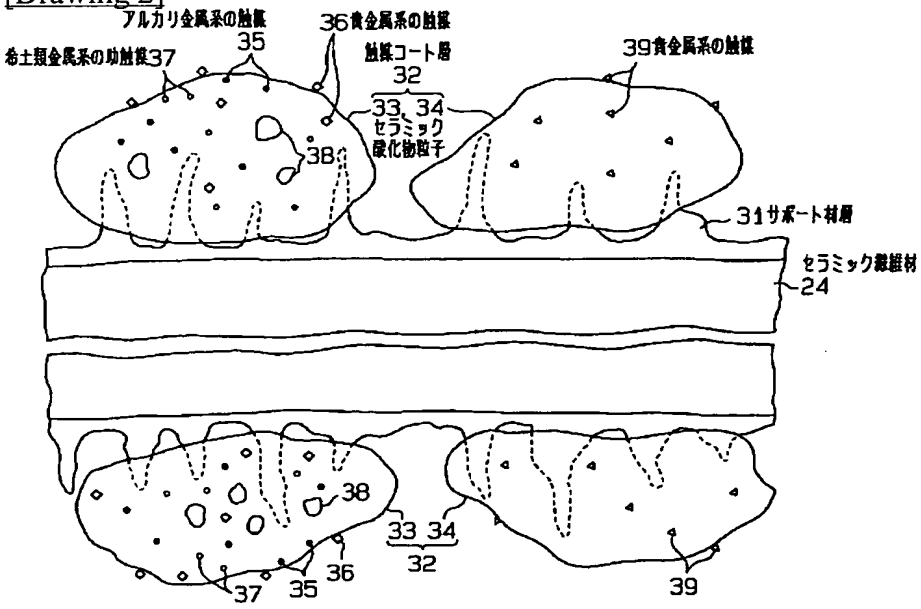
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]